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Erica Wetzler
World Vision US

Jorge A. H. Arroz
World Vision Mozambique

Chulwoo Park
San Jose State University, charles.park@sjsu.edu

Marta Chande
World Vision Mozambique

Figueiredo Mussambala
World Vision International

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World Vision

Impact of mass distribution of long-lasting insecticidal nets (LLINs) in Mozambique, 2011 to 2025: Retrospective and prospective modelling of child mortality and lives saved

Erica Wetzler, World Vision US; Jorge A. H. Arroz, World Vision Mozambique; Chulwoo Park, Department of Public Health and Recreation, San Jose State University; Marta Chande; World Vision Mozambique; Figueiredo Mussambala, World Vision International.

Photo Credit: Photoshare

Introduction

- In 2017, **malaria was the leading cause of post-neonatal deaths in Mozambique.**
- Use of long-lasting insecticidal nets (LLINs) is one of the most effective ways to reduce malaria mortality in children.
- In 2011, Mozambique committed to expansion of LLIN coverage nationwide, culminating in the **first countrywide campaign** in 2017, reaching 95% of registered households.
- **Vital registration data to** measure changes in mortality are not available in Mozambique.
- No provincial or national level mortality estimates in Mozambique since 2011.
- No previous analyses have estimated changes in mortality attributable to the distribution and scale-up of LLINs in Mozambique, accounting for differences in disease and mortality patterns, and coverage of maternal and child health interventions between provinces.

Main research objective:

Estimate deaths averted in children under-5 due to LLIN distributions in ten provinces of Mozambique between 2012 and 2020 and project number of lives that can be saved in children under-5 from 2021 and 2025 if universal coverage is maintained.

Study population:

Population of Mozambique, excluding the city of Maputo, estimated at about **22 million people in 2011**.

Additional outcomes:

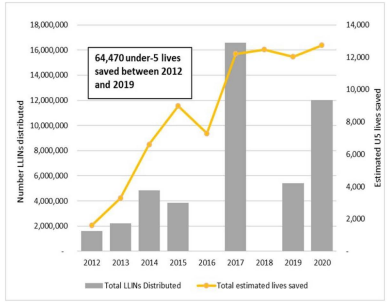
Percent reduction in under-5 mortality nationally and by province.
Estimated number of LLINs needed to maintain universal coverage by province from 2021 to 2025.

Photo credit: World Vision Malawi

Methods

- The **NetCALC tool** estimated provincial household LLIN coverage based upon actual LLINs distributed from 2012 to 2020.
- NetCALC also estimated net replacement needed to maintain universal coverage from 2021 to 2025.
- Using the estimates from NetCALC, along with key underlying demographic and mortality data, and changing intervention coverage estimates, the **Lives Saved Tool (LiST)** estimated child mortality and "lives saved" for children under-5 years of age.
- **3 sets of LiST models** were created for each province:
  - Counterfactual, which assumed no distribution of LLINs after 2011 (decline in coverage).
  - Coverage based upon actual LLINs distributed through 2020.
  - LLIN coverage if universal coverage is maintained through 2025.
- Results from 3 models were summed to **estimate the total lives saved attributable to LLIN distribution.**
- **Under-5 all-cause mortality rates were projected** in the baseline model (no LLIN distribution) and in the LLIN distribution model.

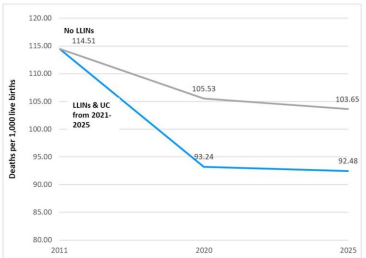
Results



Total LLINs distributed & estimated lives saved, children under-5, Mozambique, 2012 to 2020

- Between 2012 and 2019, **34,513,379 LLINs were distributed.**
- In 2017 estimated LLIN coverage reached 100% in all ten provinces, after the mass countrywide LLIN distribution that year.
- **64,470 under-5 lives were saved** due to ownership of LLINs between 2012 and 2019.
- Between 2020 and 2025, a total of **20,322,378 LLINs are needed** to achieve and maintain universal coverage.
- If universal coverage is sustained, **68,695 U5 lives** will be saved between 2021 and 2025.

- After scale-up of LLINs through mass distribution, estimated all-cause under-5 mortality decreased from 114.51 per 1000 in 2011 to 93.24 per 1,000, a **18.58%** reduction, compared to a reduction **7.84%** in the baseline model (no LLINs distributed).
- If universal coverage is sustained between 2021 and 2025, in the LLIN model under-5 mortality drops slightly from 93.23 per 1000 in 2020 to 92.48 per 1000 in 2025.



Estimated change in under-5 mortality rates (per 1,000) with and without LLIN distribution, and universal coverage (UC) after 2020

Discussion

Our results **show greater number of lives saved due to LLIN distribution than other studies** that used the LiST to estimate lives saved attributable to LLIN ownership in Mozambique. *Why?*

- Coverage levels for other interventions remained static in our study.
- Coverage levels of LLIN ownership steadily increased starting in 2012, while previous studies focused on time periods when LLINs coverage had not yet been expanded.
- The counterfactual model did not keep LLIN coverage constant, but modelled reductions in coverage had no LLINs been distributed.

Limitations

- Coverage by Indoor Residual Spraying (IRS) was not included in the analysis, but most areas covered by IRS were also covered by LLINs.
- Analysis focused only on children under-5, underestimating the full impact of LLIN distribution on the population.

Conclusions

- The LiST and NetCALC tools used together are useful to estimate lives saved and mortality where vital registration data are not consistently available.
- Multiple analyses have shown that continued investment in LLINs can result in substantial reductions in child mortality and lives saved.
- Sustaining universal coverage of LLINs may be more feasible than scaling and maintaining coverage of other key child health interventions such as ACT treatment for malaria.
- Mass **LLINs campaigns are last-mile solutions to help close the equity gap**. In Mozambique, LLINS only need to be delivered every three years, reaching the most remote vulnerable areas.

Authors and Acknowledgements

Doctor Jorge A.H. Arroz, who was instrumental in designing this study, passed away while the final analysis was underway. Dr. Arroz dedicated his life and career to improving the health of the people of Mozambique. The authors would also like to acknowledge the contributions of communities in Mozambique who help make the distribution of LLINs possible, and the commitment and dedication of the National Malaria Control Program, and district and provincial health authorities.